2010

Utilising a Combined Exercise and Counselling Program to Examine the Relationship Between Emotional Self-Efficacy and Physiological Improvements in Breast Cancer Survivors

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Publication Details

Buchan, J. K. (2010). Utilising a Combined Exercise and Counselling Program to Examine the Relationship Between Emotional Self-Efficacy and Physiological Improvements in Breast Cancer Survivors (Master of Health Sciences). University of Notre Dame Australia.
http://researchonline.nd.edu.au/theses/45

weeks of the study, with no other significant changes from baseline to 20 weeks observed (Table 13).

Table 13

20-week Changes in Upper Arm and Forearm Circumferences for Participants by Group

	Right Forearm		Left Forearm		Right Upper Arm		Left Upper Arm	
Group	**M (Range)**	***P***	**M (Range)**	***p***	**M (Range)**	***p***	**M (Range)**	***p***
C	-0.5 (-0.5- -1.5)	0.042*	-0.3 (-1.5-0.5)	0.498	-1 (-5-2)	0.416	-0.5 (-4-3)	0.892
Ex	0 (-0.8-1.5)	0.465	0 (-1.2-1)	0.715	0 (-2.3-2)	1.000	-1.2 (-2-1)	0.144
ExC	-1 (-2-0)	0.068	-0.5 (-1-0)	0.102	0 (-2-0.5)	0.414	0 (-1.5-1.9)	0.581
UsC	-0.75 (-1-0.5)	0.194	-0.75 (-1.5-0.5)	0.197	-0.5 (-4-1.5)	0.593	-0.75 (-4-1.5)	0.465

Note. M, median; C, counselling-only; Ex, exercise-only; ExC, exercise and counselling; UsC, usual care
* $p < .05$

CHAPTER 5

Discussion

Overview

The aim of this study was to determine if a combined exercise and counselling program could improve emotional self-efficacy and physical well-being, and if a link existed between program adherence and resulting improvements. Overall, the results of this study suggested exercise and counselling were capable of producing psychological and physiological benefits. Exercise appeared to impact physiological domains, as expected, while both exercise and counselling resulted in improvements in emotional self-efficacy, though the combination of the two modalities appeared most beneficial. Additionally, these improvements were attainable without producing adverse effects such as lymphoedema.

In relation to emotional self-efficacy, overall results suggested a combination of exercise and counselling most beneficial for producing improvements in this parameter, supporting the study's first hypothesis. C, Ex, and ExC all improved emotional self-efficacy over the first 8 weeks and full 20 weeks of the study, while

UsC actually declined until enrolled in the 12 weeks of exercise and counselling, though remained with an overall score decrease by the end of the program. Differences were not significant, as hypothesised, but this overall decline in UsC and a decline in the Ex group's scores from week 12 to week 20 were unexpected.

Findings from this study generally supported the hypothesis that partaking in exercise would lead to physiological improvements in the Ex and ExC groups compared to C and UsC over the first eight weeks. Though most changes did not reach significance, group differences were typically a result of C and UsC declining in physical well-being and Ex and ExC improving. In disagreement to this hypothesis was the observation that a catch-up effect occurred and all groups were balanced in physical parameters at the conclusion of the study, regardless if exercising for only 12 weeks (C and UsC) or the full 20 weeks (Ex and ExC).

Contrary to what was hypothesised, no significant correlations were observed between adherence and resulting psychosocial or physiological improvements. Also unexpected was the finding that lower baseline emotional self-efficacy levels were found to correlate with greater overall physiological and psychological improvements in select parameters. Additionally, contrary to expectations was the finding that higher final emotional self-efficacy levels were associated with greater increases in weight and BMI over the 20-week program.

Adherence

Adherence is essential for a program to be successful, and care should be taken to monitor attendance rates and track reasons for missing seasons. Doing so may allow for better insight into why participants may not embrace a program or upkeep it. In the breast cancer population, it is essential to find ways to keep participants engaged in physical activity, as long-term maintenance has important implications for survivorship (Holmes et al, 2005). The four treatment groups in this study showed varying rates of exercise adherence, with an overall average attendance rate of 75.1%. Ex participants averaged 81.8% of sessions, C attended 80.4%, ExC attended 77.4%, and UsC participants came to 69% of sessions, with no significant difference in attendance ($p=0.872$).

Though no other similar programs involving both exercise and counselling were available for direct comparison, adherence to exercise in this study fell within the range of rates observed in other exercise-only studies conducted with a post-treatment population. Milne et al. reported exercise adherence rates in a 24-week study utilising an immediate exercise group (IEG) and delayed exercise group (DEG), only measuring adherence during the 12 weeks of the study when each group was involved in supervised exercise (2008). Overall adherence was 61.3%, with the IEG attending 60.4% of sessions and the DEG participants averaging 62.2%. A 15-week aerobic intervention by Courneya and colleagues involved 53 postmenopausal women assigned to either an exercise group or a control group (2003). Overall exercise adherence was found to be 98.4% of supervised cycle ergometer sessions attended. A home-based walking program conducted by Matthews et al. found self-reported adherence rates of 94% when enrolling 23 women in a 12-week intervention (2007). However, none of the studies discussed reasons for the observed adherence rates or examined potential correlates with adherence, as the current study did.

Only one study could be found that examined potential predictors of adherence, a 12-week home-based aerobic exercise study that based adherence on percentage of participants meeting weekly exercise goals (Pinto, Rabin, & Dunsiger, 2009). Average rates over the 12 weeks were 69.76% achieving weekly goals, with highest adherence in week 2 (90.7%) and lowest adherence in weeks 7 and 9 (53.9%). This drop in adherence is similar to what was observed in the Ex and ExC groups in this study when comparing attendance in weeks 1-8 to that in weeks 8-12. Ex was found to decrease from 92.6% of sessions attended to 73.6%, while ExC went from 88.2% to 70.2%. Pinto and colleagues suggested their observed decline may have resulted from exercise goals being easy to meet in the first weeks and therefore resulting in higher adherence, or, additionally, from the intervention novelty wearing off after the initial weeks (2009).

It is possible that the adherence drop observed in the current study in the Ex and ExC groups may have resulted from the intervention novelty wearing off after the first eight weeks. Additionally, many of the women began returning to or increasing

hours at work as the program progressed, along with 2 of the 10 women in the Ex and ExC groups sustaining outside injuries during the latter half of the intervention that impacted their ability to exercise. Minimal changes in weight from baseline to eight weeks may have also resulted in decreased adherence, as participants may have felt they were not achieving the results they wanted (Ex: $\bar{x}\Delta$=0.74 kg; ExC: $\bar{x}\Delta$= -0.72 kg). Despite other physiological parameters improving during this time, such as cardiorespiratory endurance and upper body strength, problems with weight and body image have been identified as one of the greatest concerns in post-treatment women (Ganz et al., 1996). However, each woman was encouraged to make one of their program goals to maintain, rather than reduce, weight. This was done because 18 of the 19 participants were still undergoing hormone therapy, a treatment that has been linked to weight gain (Garreau et al., 2006). To achieve noticeable decreases in weight, participants were informed that a lifestyle change relating to areas like diet would need to accompany exercise, but that was not something monitored by this study. More participant feedback is necessary to better understand the impact of these physical issues on the observed decline in adherence.

As C and UsC participants were only enrolled in exercise from the 8-week assessment to the final 20-week assessment, there was only one adherence period for these groups. C attended 80.4% of sessions, and UsC only adhered to 69%, though the rate in UsC was primarily brought down by one patient with attendance of 33%. This low rate was a result of travel issues impacting ability to attend gym sessions, and a chronic back injury making her hesitant to engage in home-based exercise. Without this result, average UsC adherence was 81%, which was similar to the other groups' averages. However, both C and UsC exhibited lower adherence during their initial exercise period than Ex or ExC. Ex participants had an adherence of 92.6% during the first 8 weeks they exercised, while ExC averaged 88.2% of sessions. As the C and UsC groups had 12 weeks, rather than 8 weeks, corresponding to their initial adherence rate, it may be that novelty wore off and negatively impacted attendance. This is supported by Pinto and colleagues finding lowest adherence rates in weeks seven and nine. Since the exercise component for these two groups was introduced in the second phase of the intervention, some participants had started transitioning back to more regular work hours. Additionally, groups only had to

commit to one day (C group) or no days (UsC) for the first eight weeks, possibly making it difficult to then fit three exercise sessions and one counselling session into their weekly schedule. Finally, in relation to all groups, adherence may have been negatively impacted by the structure of the gym sessions. Participants did not have a designated attendance time, but rather were able to attend any time before 11 on Monday, Wednesday, and Friday mornings. Each woman was assigned a trainer for at least the first eight weeks of her program, which may have helped motivate initial attendance, but was then transitioned to a majority of self-directed workouts to promote autonomy and confidence. This transition, while allowing for potential better long-term exercise maintenance, may explain some of the drop in adherence observed over the course of the program.

One other important component of the current research was examining the potential link between baseline emotional self-efficacy levels and adherence. It is essential to identify factors that may promote greater adherence, as better maintenance of exercise may have important clinical implications for enhancing survivorship (Holmes et al., 2005). Contrary to what was hypothesised, no significant correlation was observed between these parameters. No other studies are available for direct comparison, as other exercise interventions that have examined predictors of adherence have measured exercise self-efficacy rather than emotional self-efficacy (Karvinen et al., 2007; Pinto et al., 2009). Exercise self-efficacy relies on confidence in physical abilities, whereas emotional self-efficacy is related to areas like coping and social interactions.

It may be that the improvements in emotional self-efficacy observed in the current study were more related to embracing the counselling component, rather than to exercise adherence. Interestingly, of the two participants that chose not to partake in counselling, one (UsC) had an exercise adherence of 33% and overall decrease in self-efficacy score of -87.33, while another (Ex) dropped to from 100% to 55% adherence from week 8 to week 20 and also decreased emotional self-efficacy by 5.33 during this time. Though no overall correlation was observed between 20-week emotional self-efficacy changes and exercise adherence, of interest was the finding that the four women in Ex who unexpectedly decreased in emotional self-efficacy

levels during the second phase of the intervention, when their counselling component was introduced, were also the ones with the greatest reduction in adherence. It would be worthwhile to further explore the relationship between counselling, emotional self-efficacy, and exercise adherence in future studies. Additionally, it may be important to note those participants decreasing in emotional self-efficacy, as they may be at a greatest risk for corresponding declines in physical activity.

There are a few potential reasons why no correlation was observed between emotional self-efficacy and exercise adherence. With only 19 participants, it may be difficult to observe significant correlations due to the greater impact outliers may have. Additionally, adherence rates for the Ex and ExC group were related to a 20-week period, whereas those for the C and UsC participants were from the 12 weeks they exercised. The use of baseline self-efficacy scores may also have impacted ability to observe significant correlations, as these values were those obtained from the initial assessment. Adherence for Ex and ExC was recorded beginning immediately after this assessment, while C and UsC did not begin exercise, and as a result adherence calculation, until eight weeks later. However, classifying "baseline" for these two groups as the eight-week assessment self-efficacy score would have been impacted by the treatment they received from weeks zero to eight (counselling or usual care).

Though not included in data analysis, it is worthwhile to highlight that baseline emotional self-efficacy levels of the two participants who dropped out of the study were lower than those of all but one of the women who remained in the program. Their scores were 19.33 and 21.33, compared to an overall study mean of 76.45, suggesting that it may be important to determine baseline self-efficacy scores to identify those participants most likely to not adhere. The one study participant who scored equally low, at 20.67, was randomised to the ExC group, whereas the two drop-outs were in UsC, so it is possible the immediate introduction of the program, rather than 8 weeks of no intervention, may have contributed to her remaining in the study. It would be beneficial to stratify groups on baseline self-efficacy scores to provide support for this potential explanation.

Emotional Self-Efficacy

Emotional self-efficacy is an important psychosocial concept in relation to a woman's recovery from breast cancer. It may influence areas such as coping methods, mood and perceived quality of life, and physical activity levels (Cunningham, Lockwood, & Cunningham, 1991; Valois et al., 2008). A positive finding from this study was that C, Ex, and ExC all improved emotional self-efficacy levels compared to UsC during the first eight weeks of the study, when participants were still in their separate group programs. Additionally, analysis revealed this improvement was greatest in the group receiving both exercise and counselling. During the second phase of the intervention, when all participants were enrolled in exercise and counselling, C, ExC, and UsC improved in emotional self-efficacy levels as predicted. Unexpectedly, Ex participants actually experienced a mean decrease in scores, with four of the five women declining in emotional self-efficacy from week 8 to week 20.

No known studies are available for direct comparison of the impact of a combination exercise and counselling program on emotional self-efficacy. Previous research has only utilised the two modalities in isolation to examine the impact on emotional self-efficacy. Giese-Davis and colleagues found metastatic breast cancer patients enrolled in supportive-expressive group therapy were able to maintain emotional self-efficacy levels over a year, while the control group declined (2002). In a supportive-expressive group therapy grogram with primary breast cancer women, no significant differences between the therapy and the control group were observed after 12 weeks (Classen et al., 2007). However, the findings of these studies should be related to the current study with caution, as group therapy does not recognise and address each woman's individual situation and needs as well as one-on-one counselling may. Giese-Davis et al. are they only known research utilising this type of counselling and examine the impact on emotional self-efficacy, though their study involved women still in treatment and peer, rather than professional, counsellors (2006). No significant changes in emotional self-efficacy levels were observed in either the patients or their post-treatment peer counsellors, but it was noted that emotional expression and active coping were common session topics.

No known exercise program studies have examined the impact of such interventions on emotional self-efficacy. However, research has shown exercise is beneficial for producing changes in other psychosocial parameters. Post-treatment women decreased affective and cognitive/mood fatigue in two different studies after a six-month aerobic and resistance training program (Hsieh et al., 2008; Schneider et al., 2007). Another study with post-treatment survivors found 12 weeks of exercise resulted in increased quality of life, self-determined regulation for exercise, and psychological needs satisfaction, as well as decreased social physique anxiety (Milne et al., 2008). While parameters such as these may be related to emotional self-efficacy (Classen et al., 2001), these findings do not allow comparisons with the current study.

With no other studies available for direct comparison, it is not possible to say whether the resulting changes in emotional self-efficacy were typical. Based on what seems to constitute emotional self-efficacy and the expected benefits of counselling and exercise in isolation, the observed changes in this study from baseline to week eight were as hypothesised. Exercise was expected to benefit self-efficacy, as it has been shown to positively impact mood and perceived social support (Mutrie et al., 2007; Rovniak et al., 2002), and this expectation was supported by a median 8-week score increase of 6 in the Ex group. Counselling was also shown to improve emotional self-efficacy as hypothesised (median=12), based on the expectation that counselling allows healthy emotional expression and provides a form of social support (Han et al., 2005). When exercise and counselling were administered together, scores over the first eight weeks were found to increase as well (median=17.3), which was expected since this group received the benefits from both modalities. Additionally, all groups improved emotional self-efficacy more than UsC, who actually decreased in scores, supporting the first research hypothesis. Once all groups enrolled in exercise and counselling during the final 12 weeks of the study, emotional self-efficacy was found to increase in C, ExC, and UsC as hypothesised. Unlike what has hypothesised, however, was the finding that Ex participants actually experienced a mean decrease in scores. This decrease was not enough to result in significant differences between groups in emotional self-efficacy levels at the end of the 20 weeks though, which was hypothesised. A few factors

may have resulted in this unexpected decline in the Ex group. The four out of five group members who declined in self-efficacy scores were also the ones who had the largest drops in adherence in the group after the eight-week assessment. This may have resulted in a decrease in the benefits of exercise on self-efficacy, leading to a score decrease. Also, the introduction of counselling may have made the women more aware of their emotional issues and consequently resulted in more honest answering of the self-efficacy questionnaire. A later assessment, after longer enrolment in the counselling component, is needed to support this possibility. Finally, reports from the program counsellor revealed that the members of this group were most likely to cancel sessions or not initially embrace the counselling, with one participant deciding not to partake in counselling after her initial session.

In looking at emotional self-efficacy, it is important to note the difference in group median scores at baseline. Though not statistically significant, the 36-unit difference in group scores may have clinical importance. However, as the Stanford Emotional Self-Efficacy Scale is a relatively new tool for assessing self-efficacy, no information could be found on what is considered a minimally important difference for this scale. To examine if any groups experienced a clinically significant change from baseline to the end of the 20-week intervention, Jacob Cohen's suggestion of using an effect size of 0.50 was utilised (1988). ExC exhibited the most substantial change over 20 weeks, with an effect size of 0.87, followed by C at 0.83. Neither Ex (0.026) or UsC (-0.054) were found to experience clinically significant improvements over the course of the intervention. This finding supports the earlier results suggesting a combination of exercise and counselling is most beneficial for increasing emotional self-efficacy, though initially beginning participants in counselling prior to exercise may be almost as effective. Additionally, these similar improvements between C and ExC are strengthened by the fact that their baseline median self-efficacy scores were very similar (C=54, ExC=54.67).

Emotional self-efficacy was also examined in relation to overall physiological parameters, as research has suggested there may be a link between self-efficacy and physical functioning and activity levels (Morris and Ingham, 1988; Mosher et al., 2008; Rogers et al., 2005; Valois et al., 2008). Though it was hypothesised that

higher baseline self-efficacy would correlate with greater overall improvements, findings did not support this expectation. Lower baseline levels were actually seen to correlate with greater 20-week improvements in both flexibility and emotional self-efficacy, the reverse of what was expected. It may be that participants with lower self-efficacy at the start had the most to gain from the intervention, resulting in the observed correlations. This potential reason is clinically relevant in that identifying patients with low emotional self-efficacy may be a way of identifying those who may benefit most by an intervention like the current study.

One final relationship examined was between emotional self-efficacy and increases in weight and BMI, as studies have suggested part of the weight gain commonly seen in breast cancer survivors may be associated with psychological variables (Kumar et al., 1997). Levine and colleagues even found that weight gain appeared linked to a decrease in emotional self-efficacy (1991). The only correlations resulting from the current research were between final emotional self-efficacy levels and overall 20-week changes in weight ($r=0.466$; $p=0.044$) and BMI ($r=0.432$; $p=0.065$), though the relationships were opposite to what was expected. Greater overall weight and BMI increase were actually seen to correspond with higher final self-efficacy levels. One possible explanation may be that counselling aided women in becoming more comfortable with themselves, helping them learn not to let issues like weight have such an impact on psychological well-being. Additionally, average weight change in this study was actually a decrease of 0.264 kg, with the highest gain only 2.7 kg over 20 weeks. In the Levine et al. study, average weight increase was 6.07 kg, though this was over a 2-year period (1991). As this study was strictly observational, with no exercise or counselling program implemented to try and induce weight or self-efficacy changes, it is hard to accurately relate the findings to the current research.

Also observed in the current study was that an overall mean decrease in percent body fat ($\bar{x}\Delta = -0.49$) was seen from baseline to the end of the 20 weeks. Many of the women that were observed to experience a slight weight gain also decreased their body fat, so it may be possible that increased weight resulted more from the addition of muscle than fat. A body composition method like DEXA would need to be utilised to confirm whether decreased body fat was accompanied by a gain in lean

body mass and provide support for the above claim. It would be worthwhile to examine if a longer-term exercise and counselling intervention revealed similar correlations between emotional self-efficacy and weight as those seen in this program, due to the clinical implications. Since exercise programs are often unable to significantly reverse the weight gain seen in correspondence with breast cancer treatment (Kirshbaum, 2006; Markes, Brockow, & Resch, 2006; McNeely et al., 2006), it becomes important for body image and self-esteem to target other parameters that may be more responsive to interventions. As an overall average increase was observed in this study in emotional self-efficacy scores, it may be beneficial to consider self-efficacy as one potential parameter to focus on.

Physiological Improvements

Body composition. Body weight and composition, often negatively impacted by cancer treatment, is an important component of overall health. The weight gain and shift in body composition to more fat mass at the loss of lean body mass may damage a woman both physically and psychologically. A positive finding from this study was the reduction in body fat in all groups once enrolled in exercise. Additionally, no significant increases in weight or BMI were observed once a group began exercise, with 11 of the 19 participants actually losing weight by the end of the 20 weeks. These findings have favourable clinical ramifications for the women in this study, as weight gain in this population has been linked to a decrease in quality of life and increased risk of developing other disorders such as diabetes and hypertension (Demark-Wahnefried et al, 2002). Research has also suggested that weight gain may be associated with higher recurrence and mortality rates (Kroenke et al, 2005).

Though declines in percent body fat did not reach significance in this study either between or within groups, it is encouraging that as little as eight weeks appeared capable of producing positive body composition changes. During the first eight weeks, both Ex and ExC participants experienced a mean decrease in body fat ($\bar{x}$ = -0.35% and -0.56%, respectively), though the median body fat change for Ex was positive (0.4%; ExC= -0.5%). However, both non-exercising groups increased in mean and median percent body fat (C: $\bar{x}$ =1.22%, median=1%; UsC: $\bar{x}$ =0.83%,

median=0.81%). The few participants in either Ex or ExC that experienced an increase in body fat during the first eight weeks were actually able to bring about a decline during the second phase of the intervention.

Once C and UsC subjects began exercising, Δ values from 8 weeks to 20 weeks reveal a mean and median decrease in both groups' body fat ($\bar{x}$ Δ= -1.534% and -0.811%, respectively; median= -1.671% and -0.995%). Additionally, only one of these nine participants increased body fat (Δ=0.738%), which may be in part to an exercise adherence level of only 64% (compared to $\bar{x}$ =77.15%). She was also the youngest participant (age 37), which may have contributed to the observation of an increase in subcutaneous adipose tissue, as research has shown older women tend to increase in visceral rather than subcutaneous tissue more than younger women (Zamboni et al., 1997). As skinfold measurements reflect subcutaneous adipose tissue, it is possible that utilising a method to measure visceral adipose tissue, such as a CT scan, would have yielded different results in the older participants. A longer enrolment of all groups in exercise would likely have yielded a greater decline in percent body fat, as body composition changes occur over longer time periods, and this would have increased the likelihood of observing significant results.

Little variation was observed in weight and BMI for any group, with only C exhibiting marginally significant declines from baseline to study completion (p=0.062). No significant change in these parameters was expected, as 18 of the 19 women were still undergoing hormone therapy, which has been commonly associated with weight gain (Garreau et al., 2006). The short-term aim set for the participants in this study, therefore, was to maintain rather than reduce weight, which this program achieved ($\bar{x}$ Δ20wks= -0.264 kg). A longer intervention, or one with fewer participants receiving hormone therapy, would likely have revealed more significant reductions in these parameters.

The observed mean decrease in weight ($\bar{x}$ = -0.153 kg) and body fat ($\bar{x}$ = -1.005%) occurring with exercise participation supported the trend observed in other studies combining aerobic and resistance training, suggesting exercise may be an effective

way to combat this harmful weight gain. Battaglini and colleagues utilised a six-month individualised exercise intervention incorporating aerobic and strength training, finding significant differences between the control group and the exercise group's percent body fat at the conclusion of the program (31.2 versus 25.9%, p=0.004) (2007). Another six-month exercise intervention by Demark-Wahnefried et al. found participants significantly decreased body fat compared to historical controls (p=0.002) and lost more body mass (p=0.02) and fat mass (p=0.04) (2002).

A positive shift in body composition has also been linked to improved quality of life and better psychosocial functioning in the form of higher self-esteem and lower depression levels (Courneya et al., 2007b). Though no significant correlations were observed in the current study between percent body fat lost and emotional self-efficacy improvement, both parameters were seen to change for the better over the 20-week intervention. It is possible that larger subject numbers may have revealed a relationship between the two parameters.

One additional issue was the finding that differences between group baseline BMI values, while not statistically significant, were of clinical importance. There was a 5.6 unit range in values, and a 1-unit difference is usually deemed clinically significant. These BMI differences may have impacted a variety of parameters in the study apart from the ability to observe differences between groups following the intervention. Karvinen and colleagues found female cancer survivors with higher BMIs were less likely to adhere to exercise and exhibited lower self-efficacy (2007). In relation to the current study, C had the lowest median baseline BMI (24.1 kg/m^2) and 2nd-highest adherence (80.4%), while ExC had the highest baseline BMI (31.4 kg/m^2) and 2nd-lowest adherence (77.4%). Though these findings did not completely agree with the findings of Karvinen et al., it would be worthwhile to examine this relationship in a larger study with BMI balanced at baseline. The same is relevant in relation to self-efficacy scores, as C and ExC exhibited the lowest baseline values (C=54, ExC=54.67) despite the significant difference between the groups' BMI values.

Cardiorespiratory endurance. Adequate cardiorespiratory endurance is a necessity for daily functioning and overall quality of life, aiding individuals in carrying out activities of daily living. The fatigue and decreased physical activity levels commonly observed during and following breast cancer are likely to negatively impact endurance levels, which in turn heightens fatigue and decreases physical activity even more. The resulting increase in cardiorespiratory function ($\dot{V}O_{2max}$) observed in this study is clinically significant, as it may help combat this detrimental feedback loop. Maintaining aerobic fitness has important implications for disease risk, and has also been linked to improved quality of life and lower fatigue and depression in breast cancer patients (Courneya et al., 2007a). Study findings of increased cardiorespiratory endurance following an exercise intervention are consistent with the findings of recent meta-analyses, despite various measures being used to assess this variable (Kim, Kang, and Park, 2009; Markes, Brockow, and Resch, 2007; McKneely et al, 2006).

Devising a program that can preserve or increase aerobic fitness offers both short- and long-term benefits for the participant. In a study by Segal et al., patients in a supervised walking program were found to significantly improve their predicted $\dot{V}O_{2max}$ values as compared to a usual care control, but only if they were not undergoing chemotherapy (2001). These findings were similar to the current study, as groups undergoing exercise improved aerobic fitness while those not partaking in an exercise program experienced either no change (UsC) or a decrease (C) in fitness. Another study by Courneya et al. examining breast cancer patients currently undergoing chemotherapy found significant fitness improvements in the aerobic exercise group when compared to a resistance exercise and a usual care group (2007b). No mention was made of increasing exercise intensity over the duration of Segal's study (2001), whereas Courneya and colleagues progressively increased both intensity and duration over the course of the intervention, possibly resulting in the observance of significant changes (2007b). Additionally, the resistance training exercise group in Courneya's study did not experience significant cardiorespiratory fitness increases, suggesting the importance of including an aerobic component in exercise interventions (2007).

Though no significant differences were observed between or within groups at eight weeks, after half the participants had been enrolled in exercise (Ex and ExC groups), C decreased mean $\dot{V}O_{2max}$ ($\bar{x}\Delta$= -4.23 mL·kg^{-1}·min^{-1}), while Ex, ExC, and UsC improved endurance ($\bar{x}\Delta$=4.84, 1.06, and 0.5 mL·kg^{-1}·min^{-1}, respectively). Caution must be taken in interpreting these results, however, due to the small subject number per group. The decline observed in C was primarily from one participant decreasing fitness by 8.08 mL·kg^{-1}·min^{-1} and another by 14.8 mL·kg^{-1}·min^{-1}, reflected by a group median change of 0.3 mL·kg^{-1}·min^{-1}. This second subject was older than most other participants (age 70, $\bar{x}$=52 years), potentially contributing to this substantial drop in aerobic fitness. It is unknown why the other C participant experienced such a notable decline. In regards to UsC, the unexpected mean increase in cardiorespiratory endurance was primarily influenced by one subject improving by 5.33 mL·kg^{-1}·min^{-1}, supported by the observation that the group median change was -0.15 mL·kg^{-1}·min^{-1}. The improving participant reported that she began walking more frequently during the eight weeks of usual care, which likely explains this increase. Her data were still included in analysis because she did not join a structured exercise program, which was the only exclusion criteria related to incidences like this. UsC and C participants were asked to maintain normal activities during the first eight weeks, but they could not be forced to refrain from something like walking.

Group differences were observed in $\dot{V}O_{2max}$ values from week 8 to week 20 (p=0.036), once all participants engaged in exercise. C, ExC, and UsC all improved mean aerobic fitness in this second phase of the intervention, while Ex actually declined by 1.06 mL•kg^{-1}•min^{-1}. Though this decrease coincided with decreased exercise adherence compared to the first 8 weeks (72.6% versus 92.6%), the same trend was seen in ExC (70.2% compared to 88.2%) without a corresponding aerobic fitness decrease. This finding in the ExC group is likely due to one participant improving by 13.26 mL•kg^{-1}•min^{-1} over the 12 weeks, and also exhibiting the highest adherence during this time (84%). Such findings suggest the importance of emphasising physical activity maintenance and examining ways to continue

adherence. Also, the median change in aerobic fitness for the Ex group was 0.8 $mL \cdot kg^{-1} \cdot min^{-1}$, making follow-up study with larger subject numbers essential.

As hypothesised, both C and UsC improved aerobic fitness once commencing exercise ($\bar{x}\Delta$=8.12 and 5.84 $mL \bullet kg^{-1} \bullet min^{-1}$, respectively; median=7.8 and 5.78). This observed mean increase in the C group partly resulted from one participant improving by 17.6 $mL \bullet kg^{-1} \bullet min^{-1}$, the same one that had such a substantial drop during the first eight weeks. Though age may have factored into this observed increase, it is more likely due to her low level of fitness at the start of exercise (14.9 $mL \bullet kg^{-1} \bullet min^{-1}$, compared to $\bar{x}$=29.1 $mL \bullet kg^{-1} \bullet min^{-1}$), leaving significant room for improvement compared to those with relatively good baseline fitness. This explanation is supported by the other participant of a similar age (72 years) only improving by 5.36 $mL \bullet kg^{-1} \bullet min^{-1}$, but having a much higher initial fitness level (23 $mL \bullet kg^{-1} \bullet min^{-1}$).

Though no significant correlations were observed in this study between cardiorespiratory endurance and emotional self-efficacy, other programs have found links between aerobic fitness and psychosocial parameters. Schneider and colleagues found a 6-month combination aerobic and resistance training program capable of significantly improving cardiorespiratory endurance ($p<0.05$) in breast cancer women both in and completed with treatment (2007). Both groups also experienced reductions in behavioural, sensory, and total fatigue ($p<0.05$), but only post-treatment participants increased psychological-based fatigue domains as well (affective and cognitive/mood, $p<0.05$). Hseih et al. found the same physical and psychological changes in a similar study involving only post-treatment women (2008). Improved aerobic fitness has also been observed in conjunction with increased positive mood (Mutrie et al., 2007), as well as decreased social physique anxiety and improved self-determined regulation (intrinsic motivation) for exercise (Milne et al., 2008), following 12 weeks of exercise. As the current study also involved participants in at least 12 weeks of exercise, and this time duration appears sufficient to induce both physical and psychosocial changes, it is possible larger subject numbers would have resulted in significant correlations between improvements in cardiorespiratory endurance and emotional self-efficacy. This is

supported by the finding that both parameters were found to improve from the beginning to the conclusion of exercise ($\dot{V}O_{2max}$: $\bar{x}\Delta$=5.31 mL•kg^{-1}•min^{-1}; emotional self-efficacy $\bar{x}\Delta$=184.25). Additionally, the ability to observe a correlation with this size of a sample may have been impacted by potential outliers, such as one participant with a baseline self-efficacy of 37.33 and 20-week change in $\dot{V}O_{2max}$ of 8.6 mL•kg^{-1}•min^{-1} and another woman with an emotional self-efficacy score of 71.33 and no overall change in $\dot{V}O_{2max}$.

Muscular strength. Muscular strength is important for overall quality of life. Declined upper-body strength can impact simple daily tasks like carrying the shopping or pushing onself up, while loss of leg strength can decrease mobility and, as a result, aerobic fitness. The overall increases in both upper-body ($\bar{x}\Delta$=10.31 repetitions) and lower-body strength ($\bar{x}\Delta$=9.5kg) observed in this study following exercise participation have favourable clinical ramifications, as strength maintenance or increase has been linked to improved quality of life and physical functioning (Courneya et al., 2007a), along with increased confidence as indicated by declining social physique anxiety scores (Milne et al., 2008). A recent study by Milne et al., combining aerobic and resistance training, found significant gains in strength from baseline to final assessment in both the immediate exercise and the delayed exercise groups (2008). Exercises used to assess these strength changes included a bicep curl, leg press and chest extension, measuring the intervention impact on both upper- and lower-body. Battaglini and colleagues found similar strength improvements in an exercise group compared to a control group using a comparable assessment method, a 1-RM protocol, involving leg extension, leg curl, lat pulldown, and chest press (2007). Another study also found significant increases in both upper- and lower-body strength, but only in the resistance training group, rather than the aerobic training or usual care group (Courneya et al., 2007b). In their meta-analysis, Markes, Brockow, and Resch found no significant changes in strength based on the two studies that measured this (2006). Neither study, however, incorporated weight training: one was aerobic-only, and another only utilised tubing as a way of providing resistance training (Crowley, 2003; Drouin, 2002). These findings highlight the importance of incorporating resistance training into an exercise

intervention aimed at producing positive increases in muscular strength and endurance.

A significant difference between groups was observed in relation to delta values from baseline to eight weeks for upper-body strength, as assessed by the YMCA bench press protocol. Both Ex and ExC increased mean and median number of repetitions after eight weeks of exercise ($\bar{x}$=8 and 5, respectively; median=9 and 4), while C decreased in mean and median strength ($\bar{x}$ = -5.4, median= -7). UsC exhibited a median increase of 1 but a mean of -1, due to one participant declining by 8 repetitions while the others increased by only 1 or 2 repetitions. Once C and UsC participants enrolled in exercise following their eight-week assessment, they were able to increase strength beyond initial baseline levels, with both C and UsC improving by a median of 11 repetitions (C: $\bar{x}$=10.6; UsC: $\bar{x}$=9.25). Both Ex and ExC improved upper-body strength in phase one and phase two of the intervention. Important to note is that, while all groups improved in upper-body strength, no significant differences existed between the groups after 20 weeks. This suggests a combination aerobic and resistance training intervention can produce substantial strength benefits quickly and then maintain these benefits as the program progresses. However, activity maintenance is necessary to keep strength, as indicated by the C and UsC groups decreasing in strength when not enrolled in exercise.

In relation to lower-body strength, assessed by a 1-RM leg press, no significant differences were seen between or within groups at any time points. As expected, Ex and ExC experienced strength improvements during the first eight weeks ($\bar{x}$Δ=12 and 8kg, respectively; median=10kg for both), while UsC and C had no median changes (UsC: $\bar{x}$Δ=5kg; C: $\bar{x}$Δ=0kg). Interestingly, C and UsC participants had the greatest overall increases in leg strength following exercise ($\bar{x}$Δ=14 and 15kg, respectively; median=10 and 15kg) compared to the two groups partaking in exercise for the full 20 weeks (Ex: $\bar{x}$Δ=6kg, median=0kg; ExC: $\bar{x}$Δ=8kg, median=10kg). However, this finding may have been influenced by one Ex and one ExC participant sustaining ankle injuries outside of the program during the second half of their enrolment in the intervention. This resulted in a 30-kg strength decline in one

subject and a 20-kg decline in the other. Additionally, the lack of significant changes from one assessment to the next may have been in part to the use of a 1-RM test, which may be harder to consistently administer. The machine used for this test only allowed for increases in 10-kg increments, and was also poorly designed for shorter subjects. A different machine or strength assessment tool may have yielded more significant improvements.

Flexibility. Maintaining flexibility is important for overall muscular fitness and functionality. The sarcopenic obesity commonly resulting from breast cancer treatment means a loss of lean body mass. This decrease leads to a decline in muscle extensibility, which is likely to translate into poorer flexibility (Schneider et al., 2007). The results of this study indicate an overall improvement in flexibility of 2.7 cm following the exercise program. This is important as it may indicate a maintenance of muscular fitness and lean body mass, though follow-up assessment is necessary to confirm these possibilities. Only one other study could be found that monitored flexibility before and following a combined aerobic and resistance training program, involving both breast and prostate cancer survivors (Schneider et al., 2007). Participants still undergoing cancer treatment had an average increase of 1 cm, while the following-treatment group improved by 1.8 cm. Later studies should aim to assess this parameter in conjunction with lean body mass to examine if a relationship does exist. If so, it may be important for interventions to ensure a program component is aimed at increasing flexibility.

Ex, ExC, and C all improved flexibility over the first eight weeks of the study (Ex: $\bar{x}$ Δ=1.7 cm, median=1.5 cm; ExC: $\bar{x}$ Δ=3.8 cm, median=3 cm; C: $\bar{x}$ Δ=0.8 cm, median=1 cm), while UsC experienced a decline ($\bar{x}$ Δ= -0.25 cm, median= -0.5 cm). The unexpected improvement in the C group is likely from one participant increasing flexibility by 8 cm during this time, though it is unknown why this change may have occurred. By the end of 20 weeks, C, Ex, and ExC participants had all increased flexibility, while UsC experienced no change once beginning exercise and counselling, resulting in a mean 20-week delta value of -0.25 cm and median value of -1.5 cm. The fact that this group had the lowest exercise adherence ($\bar{x}$ =69%,

compared to overall $\bar{x}$=77.15%) may have contributed to the decline observed in flexibility, as this parameter must be continually targeted to maintain and improve.

Limitations

Several potential limitations exist in this study. Firstly, recruitment partly relied on participants self-referring themselves to partake in the study. Irwin and colleagues found participant accrual rates higher among those who self-refer when compared to subjects recruited via a registry (2008). Those who were referred to the current program by a medical practitioner still had to initiate contact with the researchers and volunteer to participate. It is possible that women volunteering for the study, either through self-referral or following another's recommendation, may not accurately reflect the general breast cancer population (Lönnqvist, Paunonen, Verkasalo, Leikas, Tuulio-Henriksson, and Lönnqvist, 2007). As a result, the study's external validity is affected, as findings can only be generalised to those who would likely volunteer to participate in a similar research project.

Additionally, the small sample size (n=19) and characteristics of the participants significantly limits the external validity and effect size of the study findings. Distributing the 19 participants among 4 sub-groups further hinders the ability to detect significant changes, as one outlier has the potential to skew overall results. Utilising a larger sample size would minimise the impact of outliers and generate stronger findings, whereas at the moment results from this study must be interpreting with caution due to the significant potential effect of outliers.

In regards to the study population, participants were below the general average age of first diagnosis (population $\bar{x}$=60 years; study $\bar{x}$=52 years) and of good average strength and cardiovascular fitness compared to population norms (AIHW & AACR, 2008). Most women lived in the suburban areas surrounding the study location and were not limited by common participation barriers like travel difficulties or full-time work commitments. These baseline results, therefore, limit the generalisibility of findings to more urban, middle-age, fitter breast cancer survivors. This is important to note, as studies have suggested less functional, older, and more rural populations

may exhibit different responses and adherence to these types of programs (Karvinen et al, 2007, Koopman et al., 2001).

The small number of participants per group also increased the impact of external events on overall findings. When there are large groups, sickness or injury in individual subjects leading up to assessment points may negatively impact physiological results, but the data from other participants are able to minimise this effect on overall findings. With psychological assessment tools like the Stanford Emotional Self-Efficacy Scale-Cancer, one important factor for validity is test-retest reliability. Larger studies have adequate participant numbers to compensate for personal situations that may arise at assessment time and impact this test-retest reliability. This pilot study likely did not have the numbers per group to compensate for such incidences, with specific examples observed being follow-up appointments shortly after eight-week assessment time or cancer diagnosis of a family member just prior to final assessment.

With any subjective measurement, emotional self-efficacy scores were susceptible to a response shift. This was especially possible once participants began counselling sessions. When first completing the Stanford Emotional Self-Efficacy scale, women may not have consciously aware or completely honest with how they were functioning emotionally and socially. As sessions with the counsellor explored the areas assessed by the scale and allowed the women to truly recognise and start addressing issues, it may have impacted how they next completed the questionnaire. Since all groups began counselling at different times during their program, this may have affected differences observed between groups. Follow-up study would be necessary to address these potential issues

With physiological assessments, specifically in relation to cardiovascular and strength testing, there exists the possibility of learned behaviour impacting results. When participants completed the baseline assessment, many of them had never walked on a treadmill, done a bench press, or been exposed to components of the other tests. Testing the participants again at eight weeks may have led to results that reflected both actual changes and the impact of increased familiarity with the test.

This would make improvements appear greater than what they were, and declines less severe. Test-retesting a few days after initial assessment might be one way of addressing this limitation.

Another potential limitation was the study design utilised. Having participants in one of four treatment groups for the first eight weeks only may not have been long enough to truly elicit significant differences in the examined outcomes. However, it can only be assumed that a longer initial separation would have resulted in greater differences between treatment modalities. Further longer-term study is needed to confirm this. Also, exercise adherence rates can only be related to programs of similar length (12 weeks or 20 weeks, depending on treatment group). Since longer-term maintenance of physical activity is important for issues of overall health and even survival, this study is limited in its ability to predict future exercise behaviour and continuation of observed benefits (Holmes et al., 2005).

Participant recruitment may have been negatively impacted by the use of the term "counselling" in program advertisements. Despite increased growth in the public setting and knowledge about counselling services (Agnew, 2003), there sometimes still exists a reluctancy to utilise these services. Richardson and Handal sampled opinions on counselling and psychotherapy and found participants felt therapy could be effective in 26 to 50% of cases, taking at least 4 months for noticeable improvements (1995). Additionally, the sample was only moderately likely to seek this type of help if suffering from mental disturbance. Given these findings, it is possible potential participants for the current study may have been deterred by the program not guaranteeing more than three months of counselling of all groups. Additionally, women may have felt they were not experiencing substantial mental problems and therefore put off by the inclusion of a counselling component. Some of the participants in the study also mentioned they were hesitant to initially partake because women of their age and socioeconomic status are often encouraged to internalise personal difficulties and pretend to cope for the sake of family and friends.

Finally, low statistical power limited the ability to fully highlight effects brought about by the program. Participant baseline scores of the physical and psychological variables of interest may have been at high enough levels to limit the amount of change achievable in 20 weeks. If individuals with lower baseline functioning had volunteered for the study, they may have been more likely to show greater improvements and therefore yield more significant results. The presence of overall changes between groups in opposing directions without significant differences revealed by analyses highlights the insufficient power. For example, both Ex and ExC decreased percent body fat over the first eight weeks, while C and UsC exhibited an increase, but nonparametric testing revealed no difference between groups. Small sample size also has a large impact on analysis outcomes, as one or a few subjects with unexpected results can impact overall findings and significance. This is evident in the discrepancies between a group's median and mean values for variables like baseline emotional self-efficacy and strength. An additional example was the Ex group actually decreasing mean cardiorespiratory endurance over the second half of the intervention. This was the result of two participants decreasing in aerobic fitness after they had initially improved in the first eight weeks. Larger sample sizes create a greater buffer for incidences like this, helping improve statistical power.

Recommendations

Based on the limitations of this study, care should be taken with interpreting the findings. Conducting this pilot study provided a useful insight into the feasibility and efficiency of a combined exercise and counselling program, and the following recommendations may be useful in designing follow-up studies. Additionally, these suggestions may also be beneficial if attempts are made to implement such a program in the community setting.

Sampling. A larger sample size is desirable to increase the potential for achieving statistically significant findings, and to decrease the ability of one or two participants' inconsistent scores to impact group and overall results. Additionally, more participants decrease the impact of losing subjects, especially in relation to the usual care group, where retainment after eight weeks may be most challenging.

Increasing sample size may result in a group more representative of the larger population. Conducting the intervention at a few different sites throughout the community may also produce a more heterogeneous sample, though this may lead to consistency issues among locations.

Larger subject numbers will likely eliminate the baseline differences observed in this study in relation to age and radiation treatment. Obtaining a sample that is statistically equal at baseline provides a better indication of whether observied changes are more related to program participation rather than personal characteristics. Further study may also wish to stratify groups based on treatment received to examine if this type of intervention is more beneficial to certain sub-populations. Groups could also be based on age or BMI, as Visovsky emphasised older and obese populations may benefit significantly from such programs but often have difficulty adhering (2006). Examining their psychological baseline and response to a combined exercise and counselling program may give an indication of areas related to adherence and help highlight ways to better aid these often neglected groups.

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Recruitment. The recruitment methods utilised in this study, and the resulting low level of initial success, highlight the need for a revised approach. Though advertisements were distributed to numerous cancer-related groups and posted in relevant areas of most local hospitals, a longer recruitment period may have resulted in greater subject numbers as women and healthcare staff became more aware of the program and word-of-mouth advertisement increased. Additionally, a more active recruitment approach could have been utilised rather than relying on subject self-referral. Flyers could also have been mailed to participants from hospital and support-group databases, as well as attending more breast cancer events and personally distributing information sheets. This might have aided in decreasing the potential impact of differences sometimes observed between research volunteers and the rest of the population.

Also, exclusion of the term “counselling” from adverts may have an impact on recruitment. The program could be promoted as one aimed to produce physical and

psychological benefits, and then explain the specific structure once women express initial interest. Care may also be taken in emphasising that exercise will be tailored to each individual, hopefully encouraging women of all baseline fitness levels to partake.

Study Design. Future studies of longer durations are recommended, as are ones with group separation lasting more than eight weeks. This will allow for better observation of the separate benefits of exercise alone and counselling alone, as compared to a combination program. Also, longer-term programs may increase the chance of producing more significant improvements in physical parameters like body composition that take longer to change. Psychological variables are also likely to improve more over a longer term, as the initial stages of a program may be spend on simply acknowledging issues rather than learning how to address them.

As exercise is something that must be maintained to be beneficial, longer-term interventions and post-program follow-up are important to observe adherence and continuation rates. The current study saw a drop in adherence in the two exercise groups during the second phase of the program, so it is important to see if this trend continues once the program concludes or is extended. If declined participation is noted, it becomes essential to identify factors influencing this decrease in adherence. Identifying these variables could allow the development of future programs better designed to address such motivational factors and hopefully promote better activity maintenance.

Future study may also wish to compare psychological and physiological changes between a gym-based exercise group and a home-based exercise group, better allowing women who may work full-time or have travel barriers to partake in physical activity. Recent research has compared a telephone exercise group and a face-to-face exercise group to a usual care control and found similar improvements in quality of life for both exercise groups (Di Sipio et al., 2009). Additionally, both exercise groups increased their walking levels over the study duration, and it would interesting to see if such a program could equally improve areas like emotional self-efficacy as well (Harrison, Eakin, Newton, Guy, Di Sipio, and Hayes, 2009).

Though one-on-one counselling was utilised in this study, future research could be conducted examining the efficiency of group or peer counselling as well. Group counselling may be easier to implement in a community setting, but does not allow the patient-centred, individualised approach taken in this intervention. Peer counselling better addresses that drawback, though care needs to be taken in carefully training the peer counsellor and ensuring she is not negatively impacted by the experience (Giese-Davis et al., 2006). Also, as not all breast cancer survivors can easily access counselling services, especially those living in rural areas, it would be worthwhile to explore the feasibility of delivering phone- or computer-based counselling.

Assessment. Future research may utilise different tools for assessments. Though skinfolds are suggest to be relatively accurate in measuring percent body fat, they are still subject to researcher error and do not allow monitoring of lean body mass changes. Additionally, care needs to be taken when deciding on the sites to utilise for measurement, as common sites like the chest, midaxilla, and abdomen may be altered due to mastectomy and reconstruction surgeries. Research has found older women, like most of the participants in this study, accumulate body fat in the form of visceral adipose tissue rather than subcutaneous adipose tissue, which cannot be measured by skinfolds (Zamboni et al., 1997). Ideally, a DEXA may provide the most thorough assessment, allowing testing of overall body composition and bone health as well. This may be an important component to monitor in future studies, as breast cancer women are at a higher risk for osteoporosis due to average age, and potentially from treatment regime. Women on aromatase inhibitors are at an increased risk due to the therapy blocking oestrogen synthesis and its positive effect on bone health.

Additional research may also utilise other tools to assess muscular strength. Though the YMCA bench press protocol proved effective in monitoring strength gains, test termination was relatively subjective. Some women admitted to stopping due to boredom or having reached a certain number, despite likely having been able to continue. Additionally, some women were uncomfortable with the use of an unsupported bar and unfamiliarity with how to perform a bench press. Unfamiliarity

with exercise performance may have also impacted 1-RM leg press results. Additionally, the machine utilised only allowed 10-kg weight increases and was not designed for shorter participants. Future research may wish to utilise a different assessment or other style of machine. A 3-RM seated chest press and leg press or a combination muscle strength assessment protocol, like the one utilised by Milne et al. (2008), may provide a better representation of strength.

Studies may wish to better monitor upper-body function through range of motion assessments and comparison of surgery versus non-surgery side, if applicable. Care should also be taken in noting whether unilateral surgery was performed on the dominant or non-dominant side. Hayes and colleagues found women six months post-surgery exhibited better upper-body functioning, assessed via objective measures, when treatment had occurred on the dominant side (2005). This has important implications for developing individualised exercise programs and monitoring improvements. Additionally, lymphoedema has been found up to 80% more common when treatment is on the non-dominant rather than dominant side, making it important to collect treatment and dominance information during initial assessments (Hayes, Cornish, & Newman, 2005).

One additional parameter that may be important for future studies to assess is balance. Commonly seen to decline with age in the general population, breast cancer patients may further decline following treatment, as chemotherapy can result in neuropathy issues. Additionally, due to women on aromatase inhibitors having an increased fracture risk, good balance is important for falls prevention. A simple timed stork test may be sufficient in tracking balance improvements.

Psychological assessment is always difficult, as it typically relies on subject-reported data and often tries to quantify more qualitative variables. Future research may include more counsellor-based assessment and qualitative attempts to monitor psychosocial functioning. Additionally, parameters such as self-esteem and coping may be important to assess in conjunction with emotional self-efficacy, as these issues have been show to relate. Motivation, especially intrinsic motivation, is a beneficial parameter to assess, as it is essential for adherence and may also link with

a woman's self-efficacy. Care also needs to be taken to ensure that women are aware of what a questionnaire is asking, as many of the current study's participants mentioned occasional confusion about what some questions meant.

At the conclusion of an intervention like this, it may be helpful to conduct qualitative exit interviews. This would allow discovery of potential changes needed in future studies, and more importantly, it provides a chance to get an idea of the program's impact that cannot be captured by physical or psychological tests. Even when improvements, or potentially consequences, are not evident in quantitative results, that does not mean they do not exist. It is important to capture how a woman feels the program affected her, even if results do not fully reflect this.

Interventions. As this study was conducted in a university setting with small participant numbers, it was possible to supply a trainer for each participant and ensure individualised exercise programs. A larger-scale study or community program may not have adequate resources to implement this though. Research should explore the feasibility of a group exercise structure rather than spreading out participants to allow for more one-on-one training. This suggestion comes following feedback from some participants in the current study. They commented that exercising with other participants, even if doing different workouts, often motivated them to come in and helped them push themselves and realise they were not alone in their situation. Such findings are important to investigate further, and may provide support for implementation of community group programs.

Regardless of whether training is administered in a group or one-on-one setting, it is imperative to recognise variations in participant's fitness levels. As each woman undergoes a unique treatment regime and responds differently, it is necessary to tailor exercise based on this. Surgical treatment will impact areas like range of motion and muscle imbalances, while each chemotherapy or hormone therapy protocol is associated with varying side effects capable of impacting physical and psychological function. Hence, it may be most beneficial to begin an individual in a personalised one-on-one exercise program to examine functional abilities and

limitations. Once basic exercise knowledge and confidence is obtained, a group program may be feasible.

As weight gain has been identified as one of the greatest concerns in post-treatment women, it may be beneficial to incorporate some form of diet education and monitoring in future studies (Ganz et al., 1996). In order to successfully achieve noticeable, long-term weight loss, an overall lifestyle change is necessary incorporating both exercise and healthy eating habits (Demark-Wahnefried et al., 2007).

Conclusion

Findings from this study indicate marginally significant differences between C, Ex, ExC, and UsC in improving emotional self-efficacy over eight weeks. Both Ex and C in isolation appear capable of increasing self-efficacy scores, and combining the two modalities produces a similar positive outcome, while no treatment actually negatively impacts emotional self-efficacy levels. Additionally, the overall increase in emotional self-efficacy in all groups at the end of the 20-week program suggests as little as 12 weeks of exercise and counselling is sufficient to produce a catch-up effect in participants' scores, regardless of prior intervention. Further study is warranted to observe if these positive changes in self-efficacy can be maintained long-term.

This study also examined physiological improvements in body composition, cardiorespiratory endurance, muscular strength, and flexibility, finding significant differences between groups in upper body strength after the first 8 weeks, and significant differences between groups from week 8 to week 20 in cardiorespiratory endurance improvements. The eight-week strength increase observed in Ex and ExC and decrease seen in C and UsC support the expectation that exercise is capable of producing significant physical improvements, with the remaining physiological parameters improving in the Ex and ExC groups as well, though not significantly. Further, the marginally significant 12-week increases in cardiorespiratory endurance, strength, and flexibility observed in C, once these participants enrolled in the exercise component, suggests 12 weeks of activity is sufficient to produce notable

improvements. Longer studies, especially those with post-intervention follow-up, are necessary to examine if these positive physiological improvements can be maintained through continued exercise, as maintenance of physical activity has important implications for overall health and survivorship (Holmes et al., 2005).

Results did not support the hypothesis that higher baseline self-efficacy levels would be correlated with greater adherence and physiological improvements, but it was found that lower baseline emotional self-efficacy actually correlated with greater overall improvements in self-efficacy scores and flexibility. Also of interest was that the two subjects who dropped out of the study had the lowest baseline emotional self-efficacy scores. Pre-screening baseline self-efficacy may enable the identification of those who are at a higher risk of poor or no adherence to an exercise and counselling program. By recognising these individuals, it may be possible to provide them additional support, as they are likely the ones in greatest need of an intervention like the one in this study, though further study is needed. As the small number of participants in this pilot study limits the ability to observe significant correlations, follow-up research with larger participant numbers is warranted to further examine potential relationships between emotional self-efficacy and adherence and physiological improvements. If lower self-efficacy levels are again found linked with greater psychosocial and physiological improvements, it may be possible to determine survivors most likely to benefit from such an intervention by monitoring self-efficacy levels. Additionally, a potential relationship between emotional self-efficacy, counselling adherence, and exercise adherence needs to be examined further, as small subject numbers and a lack of detailed monitoring of counselling adherence may have limited the ability to fully explore potential correlations.

Study findings were also unsupportive of the hypothesis that higher weight gain would correlate with lower emotional self-efficacy, with results actually suggesting participants with the greatest increases in weight and BMI actually had higher final emotional self-efficacy levels. Again, these findings should be interpreted with caution owing to the small subject numbers. As previous research has not examined the weight gain and self-efficacy correlation in exercise or counselling interventions,

a larger-scale study is warranted. It may also be beneficial to examine body image and self-esteem in correlation with weight changes and emotional self-efficacy, as these are some of the primary long-term issues breast cancer survivors often struggle with.

Though caution should be taken in interpreting the findings of this pilot study, this research has shown a short-term combination exercise and counselling program is effective in producing both psychological and physiological improvements. Additionally, engaging in such a program appears unlikely to produce adverse effects, especially in relation to lymphoedema. However, further investigation is necessary to confirm these initial findings, and also to see if benefits can be maintained long-term, as this is important for overall quality of life and potentially decreased cancer mortality. If additional research continues to support these preliminary findings, it may be possible to finally offer breast cancer survivors a more complete recovery, decreasing both the psychological and physiological side effects of cancer.